REMARKS/ARGUMENTS

Previous to this amendment, claims 1, 2, 5, 6, 13, 17, 18, 21, and 23 were pending in the application. In the Office Action, the Examiner rejected claims 1, 2, 5, 6, 13, 17, 18, 21, and 23 under 35 U.S.C. §103(a) as allegedly being unpatentable over Billington (4,523,243) in view of Zammit (5,210,667).

With this amendment, Applicants amend claims the independent claims 1, 6, 13, and 23 to further distinguish over the prior art. Applicants further cancel claim 2, and add new claim 24. Support for support for claim 24 and the "first and second electrodes" limitation found in one form or another of amended claims 1, 6, 13, and 23 is found at least at page 16, line 27 to page 18, line 18 and in FIGs. 6-7.

Claim Rejections

In the Office Action at page 4, the Examiner asserted that the present invention of claims 1, 2, 5, 6, 13, 17, 18, 21, and 23 can be achieved by a combination of the Billington and Zammit references, stating, "a person having ordinary skill in the art at the time the invention was made [would] substitute the lapping element of Billington with the lapping element of Zammit... because to [sic] the two elements are considered art recognized equivalents...[which] simplifies the design and materials procurement by duplicating the elements within the magnetic head thereby cutting manufacturing cost."

With reference to the present specification, the performance of magneto-resistive effect elements for reproduction of information recorded on the magnetic disk is dependent on the resistance value of a magneto-resistive effect film configuring the magneto-resistive effect element. The resistance value is controlled by mechanically lapping the bearing surface exposed on the end portion of the magneto-resistive effect film. Because of this, for the purpose of finishing the lapping work to obtain a resistance value in high accuracy, the lapping work for a magneto-resistive effect film is preferably performed while the resistance value is monitored. Specifically, the resistance value of the magneto-resistive effect element is represented by a size of height (MR element height), so that the finishing accuracy +/- 0.02 μm may have been

demanded for an MR element height 0.2 to 0.6 μm, referring to page 3, lines 15-21 in the specification.

However, since the shield films (an interval is about 80 to 100 nm) sandwich the magneto-resistive effect film from the top and bottom, as shown in FIG. 3 (11, 14) and FIG. 7 (104, 105), there has been a significant problem that the short circuit phenomenon occurred between the shield films and electrodes caused by a produced scratch in the lapping work makes the reproducibility of resistance value to be detected considerably reduced, as described in the specification on page 24, lines 17-27.

To solve the above-mentioned problem, the second magneto-resistive effect element (FIG. 6, 201, with same shape and material as the first magneto-resistive effect element FIG. 6 101) is disposed close to the first magneto-resistive element (101), referring to FIGs. 6-7. The shield films are not present on the upper and lower portions of the second magneto-resistive effect film (202) as shown in FIG. 7 and described at page 24 lines 13 to page 25 line 1. Accordingly, affects of a scratch in the lapping work can be eliminated or substantially reduced. As a result, the resistance value of magneto-resistive effect film in the magneto-resistive effect element can achieve a finishing accuracy in terms of the MR element height +/- 0.02 μm (3-σ [sigma] value), as shown in FIG. 14B as compared to FIG. 14A and as described at page 25 line 24 to page 25 line 18.

Further, the resistance values of the first and second magneto-resistive effect films have an extremely high positive correlation therebetween, as shown in FIG. 13. This diagram represents that the resistance value of first magneto-resistive effect film can be controlled for obtaining a desirable value in good accuracy, by monitoring the resistance value of second magneto-resistive effect film to thereby feed back a monitored result to the lapping work.

With respect to the cited references, in contrast to the assertion of the Examiner, the combination of Billington and Zammit would not result in the claimed invention of the amended claims, for at least the reasons set forth below.

Billington discloses "lapping straps" (34) and "wear straps" (36) consisting presumably of copper, a material different from a magneto-resistive effect film (16, described as Permalloy sense elements). Billington states, "[s]tandard photolithographic techniques are used

to deposit the three copper conductors 20, 22 and 24... Thereafter, conductors are photolithographically deposited over the dielectric layer 10 and in the through-holes 44, 45, 47, 49, and 53. These conductors include the bias conductor 32 as well as lap straps 34 and wear indicators 36" *col. 3, line 54 to col. 4, lines 5-9.*

In essence, Billington teaches that lapping may be stopped when a lapping strap is worn through, stopping current flow during lapping. To detect the end of lapping, Billington teaches,

> lapping straps 34 electrically open (i.e., the sections 34a are completely lapped away) at precisely predetermined points. During lapping a voltage is applied to conductor pads 50 and 52 connected to the lapping straps 34. The resulting current flows through the lapping straps 34. The sections 34a of the lapping straps 34 are parallel to the leading edges 18 of the sense elements 16 and are positioned such that their lower edges are along the line defined by the leading edges 18. When the lapping procedure has continued to the point where the straight sections 34a of the lapping straps 34 have been lapped away completely, current will cease flowing in the straps 34 and, simultaneously, the leading edges 18 of the sense elements 16 will have been exposed. Signals resulting from the cessation of current flow will thus signal that the lapping procedure should be stopped. *Col. 5, lines 7-23.*

Essentially, Billington teaches that when the lap straps 34 wear through during lapping, current flow stops across the lap straps, signaling to stop the lapping process.

In contrast, Zammit teaches a lapping guide ***system*** that includes a resistive electrical lapping guide used to extrapolate a final resistance of a finished lapping guide. Figure 3 of Zammit includes a relatively complex configuration for the lapping guide system 36, including the resistive lapping guide (46), finished lapping guide (44), as well as an (optional) as-lapped guide (42). The resistive electrical lapping guide of Zammit is different from the finished lapping guide and, particularly, is ***different in resistance and/or height from the head element***. Zammit states,

> In accordance with the present invention, ***a lapping guide system*** includes a resistive electrical lapping guide (RLG) and an electrical

> lapping guide, called the finished lap guide (FLG), that is of a height greater than the eventual height of the read element and is lapped together with the head element. The lapping guide system is deposited on at least one end of the linear array of magnetic head elements during the deposition of the head elements. The resistive lap guide (RLG) is of a resistance and a height which can be used to extrapolate a final resistance required of the finished lap guide. The RLG may or may not be lapped. ***The electrical resistance and/or height of the RLG is different from the final resistance and/or height of either the head element or the finished lap guide (FLG).*** *Col. 2, line 34-49, emphasis added.*

As an initial matter, because the lapping guide system of Zammit includes elements that are different from the resistance and/or height of the head element, ***Zammit teaches away from the proposed combination*** asserted by the Examiner.

Further, because the lapping elements of Zammit are ***different*** from the head element, even if a skilled artisan did merely "substitute the lapping element of Billington with the lapping element of Zammit" as the Examiner stated at page 4, the combination would not result in the instant invention.

Additionally, Zammit explicitly teaches away from the proposed combination as proposed by the Examiner. The several lapping guides of Zammit are required in Zammit because,

> ***the photo-lithographic processes by which the ALG 42 and the FLG 44 are created are subject to process variations which produce variations in the final geometric dimensions of the ALG 42 and the FLG 44. As a result, the height of the ALG 42 may vary thereby building error into the target lapping resistance for the FLG 44.*** That is, the stripe and height dimension tolerance is only as good as the ALG 42 height tolerance. By using the RLG 46 and the FLG 44 height information, the RLG 46 and the FLG 44 initial electrical resistance data is used to extrapolate the target FLG 44 resistance and, therefore, the errors are reduced. The height of the RLG resistive lapping element 50 may be optimized to minimize errors in the final FLG element 52 height. *Col. 9, line 28-43, emphasis added.*

Therefore, inasmuch as Zammit teaches that multiple resistive elements are necessary within the lapping guide system, ***Zammit teaches away from the proposed combination*** asserted by the Examiner. A skilled artisan would not merely "substitute the lapping element of Billington with the lapping element of Zammit" as the Examiner stated at page 4. Zammit states that photolithographic process variations make the Examiner's proposed combination undesirable.

Notably, photolithographic limitations stated in Zammit are discussed as limitations to be solved in the instant specification, which states, "error of accuracy of machining for achieving the required MR element height is caused by...[a]n error in forming an exposure mask used for forming the magneto-resistive effect elements and the electric lapping guide elements and the exposure error in the exposure process [and] error in converting the resistance value detected by the electric lapping guide element to the MR height element." *Specification, page 4, line 13 to page 5, line 14.*

Another reason that the substitution proposed by the Examiner would not be readily followed by a person of ordinary skill is that the method for determining the end of lapping in Billington is drastically different than that taught by Zammit. Again, Billington uses a relatively simple lapping fuse method, such that when the lapping strap is worn through, current stops flowing through the lapping strap thus signaling the end of lapping. In contrast, Zammit requires a relatively complex computation to be followed to determine when lapping is complete. Zammit states,

> The lapping is stopped when the resistance of the finished lapping guide equals the formula of the formed height of the resistive lapping guide, divided by the final required height of the transducer, times the formed resistance of the resistive lapping guide, minus a quantity of the initial formed height of the resistive lapping guide, times the initial formed resistance of the resistive lapping guide, minus the initial height of the finished lapping guide, times the initial resistance of the finished lapping guide with the difference then divided by the difference between the formed height of the resistive lapping guide and the initial formed height of the finished lapping guide and that quantity added to the product.

Furthermore, even if the monitor elements (34, 36) of Billington were configured of the same material as the magneto-resistive effect film (16), the resistance value of the monitor elements (34, 36) does not directly indicate the resistance value of the magneto-resistive effect film (16). For this reason, the control method for the resistance value is carried out in accordance with a current through the monitor elements (34, 36) with on-off stated, referring to the description on col. 5, lines 24-37. Therefore, the finishing accuracy cannot be realized even by a combination of Billington and Zammit.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,

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